

REMARKS

In the Office Action, the Examiner rejected claims 30, 32-52, 54 and 55. Applicants note that the current Office Action is responsive to communication filed on July 19, 2006. However, the Applicants wish to point out that a Preliminary Amendment was filed on September 8, 2006 in furtherance to the Request for Continued Examination (RCE) filed on July 13, 2006. In the current Office Action, the Examiner failed to consider the new claims 56-72 added in the Preliminary Amendment. Thus, the present Office Action is not complete, and the next Office Action should not be made final despite the amendments set forth above.

The Applicants hereby amend claims 30, 38, 44, 54 and 55, cancel claims 59, 65, 66, and 70, and add new claims 73-76 for clarification of certain features to expedite allowance of the present application. For example, the Applicants hereby amend independent claim 30 to incorporate dependent claim 59, which was added in the previous Preliminary Amendment. In addition, the Applicants hereby amend independent claim 38 to incorporate dependent claims 65 and 66, which were added in the previous Preliminary Amendment. By further example, the Applicants hereby amend independent claim 44 to incorporate dependent claim 70, which was added in the previous Preliminary Amendment. Furthermore, the Applicants hereby amend independent claims 54 and 55 based on the subject matter recited in dependent claims 57, 61, 63, and 67, which were added in the previous Preliminary Amendment. These amendments do not add any new matter. Upon entry of these amendments, claims 30, 32-52, 54-58, 60-64, 67-69, and 71-76 will remain pending in the present patent application and are believed to be in condition for allowance. In view of the foregoing amendments and the following remarks, the Applicants respectfully request reconsideration and allowance of all pending claims.

Claim Rejections under 35 U.S.C. § 103(a)

The Office Action summarizes claims 30, 35, 36, 38-40 and 42-51 as being unpatentable over U.S. Patent No. 5,973,444 (hereinafter “Xu”) in view of U.S. Patent No. 6,255,198 (hereinafter “Linthicum”). Further, the Office Action summarizes claim 32 as being unpatentable over Xu in view of Linthicum, and further in view of U.S. Patent No. 5,157,304 (hereinafter “Kane”). Further, the Office Action summarizes claim 33 as rejected under 35 U.S.C. §103(a) as being unpatentable over Xu in view of Linthicum, and further in view of U.S. Patent No. 6,054,801 (hereinafter “Hunt”). Also, the Office Action summarizes claim 34 as rejected under 35 U.S.C. §103(a) as being unpatentable over Xu in view of Linthicum, and in view of U.S. Patent No. 6,465,132 (hereinafter “Jin”) taken with U.S. Patent No. 6,911,767 (hereinafter “Takai”). Furthermore, the Office Action summarizes claims 37 and 52 as rejected under 35 U.S.C. §103(a) as being unpatentable over Xu in view of Linthicum, and in further view of U.S. Patent No. 6,376,007 (hereinafter “Rowell”). Still further, the Office Action summarizes claim 41 as rejected under 35 U.S.C. §103(a) as being unpatentable over Xu in view of Linthicum, and in further view of U.S. Patent No. 6,586,093 (hereinafter “Laude”). Further, the Office Action summarizes claims 54 and 55 as rejected under 35 U.S.C. §103(a) as being unpatentable over Xu in view of U.S. Patent No. 5,406,123 (hereinafter “Narayan”). In addition, the Office Action included similar rejections as set forth above with U.S. Published Application No. 2002/0198112 (hereinafter “Paranthaman”) substituted for Linthicum. The Applicants respectfully traverse these rejections.

Legal Precedent

First, the pending claims must be given an interpretation that is reasonable and consistent with the *specification*. See *In re Prater*, 415 F.2d 1393, 1404-05, 162 U.S.P.Q. 541, 550-51 (C.C.P.A. 1969) (emphasis added); see also *In re Morris*, 127 F.3d 1048, 1054-55, 44 U.S.P.Q.2d 1023, 1027-28 (Fed. Cir. 1997); see also M.P.E.P. §§ 608.01(o) and 2111. Indeed, the specification is “the primary basis for construing the claims.” See

Phillips v. AWH Corp., No. 03-1269, -1286, at 13-16 (Fed. Cir. July 12, 2005) (*en banc*). One should rely *heavily* on the written description for guidance as to the meaning of the claims. *See id.*

Second, interpretation of the claims must also be consistent with the interpretation that *one of ordinary skill in the art* would reach. *See In re Cortright*, 165 F.3d 1353, 1359, 49 U.S.P.Q.2d 1464, 1468 (Fed. Cir. 1999); M.P.E.P. § 2111. “The inquiry into how a person of ordinary skill in the art understands a claim term provides an objective baseline from which to begin claim interpretation.” *See Collegenet, Inc. v. ApplyYourself, Inc.*, No. 04-1202, -1222, 1251, at 8-9 (Fed. Cir. August 2, 2005) (quoting *Phillips*, No. 03-1269, -1286, at 16). The Federal Circuit has made clear that derivation of a claim term must be based on “usage in the ordinary and accustomed meaning of the words amongst artisans of ordinary skill in the relevant art.” *See id.*

Third, the burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination. *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d. 1430 (Fed. Cir. 1990). Accordingly, to establish a *prima facie* case, the Examiner must not only show that the combination includes *all* of the claimed elements, but also a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). The Examiner must provide objective evidence, rather than subjective belief and unknown authority, of the requisite motivation or suggestion to

combine or modify the cited references. *In re Lee*, 61 U.S.P.Q.2d. 1430 (Fed. Cir. 2002). Moreover, a statement that the proposed modification would have been “well within the ordinary skill of the art” based on individual knowledge of the claimed elements cannot be relied upon to establish a *prima facie* case of obviousness without some *objective reason to combine* the teachings of the references. *Ex parte Levengood*, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993); *In re Kotzab*, 217 F.3d 1365, 1371, 55 U.S.P.Q.2d. 1313, 1318 (Fed. Cir. 2000); *Al-Site Corp. v. VSI Int’l Inc.*, 174 F.3d 1308, 50 U.S.P.Q.2d. 1161 (Fed. Cir. 1999).

Fourth, when prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988). One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). The Federal Circuit has warned that the Examiner must not, “fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.” *In re Dembiczak*, F.3d 994, 999, 50 U.S.P.Q.2d 52 (Fed. Cir. 1999) (quoting *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983)).

Fifth, it is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 U.S.P.Q. 769, 779 (Fed. Cir. 1983); M.P.E.P. § 2145. Moreover, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (CCPA 1959); see M.P.E.P. §

2143.01(VI). If the proposed modification or combination would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984); *see* M.P.E.P. § 2143.01(V).

Independent claim 30 and claims depending therefrom

The combination of Xu and Linthicum fails to teach a conductive layer that remains after the formation of the nanostructures

Independent claim 30 recites “at least one nanorod affixed to the substrate via the conductive epitaxial buffer layer and substantially disposed within the cavity, wherein the conductive epitaxial buffer layer remains after formation of the at least one nanorod.”

The Xu and Linthicum references, taken alone or in hypothetical combination, fail to teach or suggest the foregoing claim features. In particular, neither Xu nor Linthicum teach employing a structure even remotely similar to the conductive buffer layer that remains after formation of the nanorods. Even assuming the metal catalyst film 87 of FIG. 5D or the metal catalyst film 108 of FIG. 6D of Xu as being equivalent to the conductive epitaxial buffer layer of the present claim, Applicants respectfully submit that the metal catalyst film is meant to dissolve into the gate metal during the heating in the process of formation of the nanorods. For example, a passage cited at col. 16, lines 5-10 discloses dissolving of the metal catalyst film during the formation of the nanorods. The cited passage reads:

[H]eating in an atmosphere containing a carbon source to grow carbon emitters 78 on the exposed substrate inside of the gate openings. During heating, the metal catalyst on top of the gate metal dissolves into the gate metal and does not readily catalyze the formation of carbon fibers on the gate metal.

Therefore, the catalyst film will not remain when the nanorods are formed. Whereas, in the present claim, as illustrated in FIGS. 2D, 4D and 4E and as indicated in the description of a passage cited at paragraph 44, lines 3-9 of the present application, the present claim recites a conductive epitaxial buffer layer that remains after the formation of the nanorods to provided several advantageous features. The cited passage reads:

The buffer layer 211 acts as a diffusion barrier and inhibits the formation of unwanted structures, such as silicides, due to interaction between the reactants and the substrate 110. The buffer layer 211 could include, for example, germanium carbide or silicon carbide applied in an epitaxial process, or a polycrystalline diffusion barrier such as W or Ti-W. In some cases the buffer layer 211 should be suitable to support epitaxial growth of the nanostructure materials of interest.

As mentioned in the cited passages, the conductive epitaxial buffer layer or the buffer layer facilitates growth of the nanostructures. Therefore, the present claim recites that the conductive epitaxial buffer layer remains after the nanostructures are formed.

Xu teaches away from having a conductive epitaxial buffer layer that remains until the formation of the nanostructures. Therefore, Xu teaches away from a combination with Linthicum to employ a conductive epitaxial buffer layer that remains after the formation of the nanostructures. Accordingly, even if the field emission device of Xu was hypothetically formed by using the epitaxial buffer layers of Linthicum, the device will not employ a conductive epitaxial buffer layer that remains after the formation of the nanostructures. For this reason, the Xu and Linthicum references, taken alone or in hypothetical combination, cannot support a *prima facie* case of obviousness of independent claim 30 and its dependent claims.

In view of the foregoing discussion, the Applicants respectfully stress that the Xu and Linthicum references, taken alone or in hypothetical combination, cannot support a *prima facie* case of obviousness of independent claim 30 and its dependent claims.

Independent claim 38 and claims depending therefrom

Cited references, taken alone or in hypothetical combination, fail to teach or suggest a conductive epitaxial buffer layer that remain after the formation of the nanostructures

Independent claim 38 recites “a plurality of elongated carburized metal nanostructures extending from the epitaxial conductive buffer layer, wherein the conductive epitaxial buffer layer remains after formation of the plurality of elongated carburized metal nanostructures, wherein the plurality of elongated carburized metal nanostructure comprises catalyst particles disposed between the epitaxial conductive buffer layer and the plurality of elongated carburized metal nanostructures at least prior to growth of the plurality of elongated carburized metal nanostructures”. As discussed above with reference to independent claim 30, the Xu reference teaches away from using a conductive buffer layer that remains after the formation of the nanostructures.

Additionally, Xu fails to teach or even suggest employing catalyst particles that are disposed between the conductive epitaxial buffer layer and the nanostructures. As illustrated in embodiments of FIGS. 2B and 2C and as described in paragraph 44, lines 1-3 of the present application, the catalyst particles are deposited on the conductive epitaxial buffer layer, and subsequently, the nanostructures are grown from the conductive epitaxial buffer layer, thereby resulting in the catalyst particles being present between the conductive epitaxial buffer layer and the nanostructures prior to the growth of the nanostructures. The cited passage reads:

An electrically conductive buffer layer 211, as shown in FIGS. 2A-2D, may be applied to the substrate 110 prior to the step of applying a plurality of spatially-separated catalyst particles 112 to the substrate 110.

For at least these reasons, the Applicants respectfully stress that the Xu and Linthicum references, taken alone or in hypothetical combination, cannot support a *prima facie* case of obviousness of independent claim 38 and its dependent claims.

Independent claim 44 and claims depending therefrom

Cited references, taken alone or in hypothetical combination, fail to teach or suggest a “conductive platform” such that the conductive platform is independent from catalyst particles as recited by independent claim 44.

Claim 44 recites “a conductive platform, having a top surface, disposed on the top side of the substrate within the cavity, wherein the conductive platform is independent from catalyst particles configured to grow the at least one nanorod.”

Applicants respectfully submit that the Examiner is mistaken in considering the catalyst metal film of Xu equivalent to the conductive platform of the present claims. Although Applicants do not intend or suggest that the specification should be read into the claims, the Applicants reiterate that the specification is “the primary basis for construing the claims.” *See Phillips v. AWH Corp.*, No. 03-1269, -1286, at 13-16 (Fed. Cir. July 12, 2005) (*en banc*). One should rely *heavily* on the written description for guidance as to the meaning of the claims. *See id.* As disclosed in the present application, the conductive platform facilitates the growth of the nanorods. *See* Application, paragraph 47, lines 1-3. The cited passage reads:

In another embodiment, a conductive platform 420, as shown in FIG. 4, may be disposed on the substrate 310 within a cavity formed in the dielectric layer 314.

Applicants respectfully submit that Xu does not teach or suggest any structure analogous to the conductive platform as recited in claim 44. In other words, Xu fails to teach or suggest any structure which is employed to raise the level of nanorods close to

the gate opening. The metal catalyst film is used as a catalyst to enhance the growth of the nanostructures. For example, a passage at col. 12, lines 27-33 of Xu recites:

The use of a metal catalyst film is a preferred approach. The patterns are easy to form, uniform, and accurate with high reproducibility when a metal film is used. After a catalyst pattern is defined on a substrate surface, the patterned electron emitters are fabricated by further heating the substrate in an atmosphere containing a carbon source.

Therefore, if at all, the metal catalyst film of Xu may be hypothetically similar to the catalyst particles 404 in the foregoing passage, but the metal catalyst film of Xu cannot be equated with the conductive platform recited in the present claim.

In view of these passages, the Applicants further note that the present application discloses and claim 44 recites that the “catalyst particles are disposed within a channel” in the conductive platform to facilitate the growth of the nanostructures. For example, a passage in paragraph 47, lines 3-5, of the present application discloses:

At least one channel 402 is formed in the conductive platform 420 and a catalyst particle 404 is placed within the channel 402. Nanorods 418 are then grown so as to extend from the top surface of the conductive platform 420.

Xu fails to disclose a conductive platform, and therefore fails to disclose the conductive platform that has catalyst particles disposed within a channel of the conductive platform.

The secondary references do not obviate the deficiencies of Xu. Hence, the hypothetical combination of Xu with Linthicum fails to disclose a “conductive platform,” as recited by independent claim 44. For at least these reasons, among others, the Applicants respectfully stress that the Xu and Linthicum references, taken alone or in hypothetical combination, cannot support a *prima facie* case of obviousness of independent claim 44 and its dependent claims.

Independent claim 54

Cited references, taken alone or in hypothetical combination, fail to teach or suggest a polycrystalline conductive diffusion barrier “wherein the at least one nanorod extends from a top surface of the polycrystalline conductive diffusion barrier” as recited by independent claim 54.

Independent claim 54 recites “at least one nanorod affixed to the substrate via the polycrystalline conductive diffusion barrier and substantially disposed within the cavity, wherein the at least one nanorod extends from a top surface of the polycrystalline conductive diffusion barrier”. As discussed above with reference to independent claim 30, the Xu reference discloses a resistive layer rather than a conductive epitaxial buffer layer. Moreover, the Xu reference teaches away from a conductive epitaxial buffer layer. Therefore, Xu also teaches away from employing a polycrystalline conductive diffusion barrier such that one or more nanorods extend from the top surface of the polycrystalline conductive diffusion barrier. The secondary reference fails to overcome the deficiency of the primary reference. For at least these reasons, among others, the Applicants respectfully stress that the Xu and Narayan references, taken alone or in hypothetical combination, cannot support a *prima facie* case of obviousness of independent claim 54.

Independent claim 55

Cited references, taken alone or in hypothetical combination, fail to teach or suggest a polycrystalline conductive diffusion barrier, “ wherein the polycrystalline conductive diffusion barrier is configured to inhibit formation of unwanted structures due to interaction between the inorganic substrate and reactants” as recited by independent claim 55.

Independent claim 55 recites a polycrystalline conductive diffusion barrier “wherein the polycrystalline conductive diffusion barrier is configured to inhibit formation of unwanted structures due to interaction between the inorganic substrate and reactants.” As discussed above with reference to independent claims 30 and 38, the Xu reference teaches away from employing a polycrystalline conductive diffusion barrier. Moreover, Xu fails to teach or even suggest a structure equivalent to the polycrystalline

conductive diffusion barrier, such that the structure is configured to inhibit formation of unwanted structures due to interaction between the inorganic substrate and reactants. In a passage cited at paragraph 44, lines 3-10, the present application discloses employing the polycrystalline conductive diffusion barrier to inhibit growth of silicides, etc. The cited passage reads:

The buffer layer 211 acts as a diffusion barrier and inhibits the formation of unwanted structures, such as silicides, due to interaction between the reactants and the substrate 110. The buffer layer 211 could include, for example, germanium carbide or silicon carbide applied in an epitaxial process, or a polycrystalline diffusion barrier such as W or Ti-W. In some cases the buffer layer 211 should be suitable to support epitaxial growth of the nanostructure materials of interest. In other cases, epitaxy may not be necessary.

Therefore, even if the Xu and Narayan references are hypothetically combined with one another, the result will not be the device of the present claim. Again, for at least these reasons, the Applicants respectfully stress that the Xu and Narayan references, taken alone or in hypothetical combination, cannot support a *prima facie* case of obviousness of independent claim 55.

Similar rejections based on Xu in hypothetical combination with Paranthamam

In the Office Action, the Examiner formulated similar rejections based on the Xu reference in combination with the Paranthamam reference, rather than the Linthicum reference. However, for substantially the same reasons as discussed above, the Xu reference is missing various claim features that are neither taught nor suggested by the Paranthamam reference. Moreover, as discussed above, the Xu reference teaches away from various modifications no matter which secondary reference is cited by the Examiner. As a result, the Examiner's rejections based on Xu in hypothetical

combination with Paranthamam cannot support a *prima facie* case of obviousness of the present claims.

Request Withdrawal of Rejections

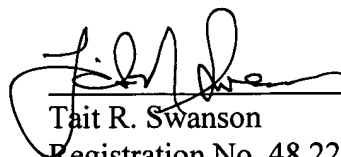
As discussed in detail above, the Xu reference is clearly missing features recited in the present claims, and the secondary references fail to obviate these deficiencies. In fact, the Xu reference generally teaches away from a modification or combination with these references as discussed above. Therefore, Applicants request the Examiner to withdraw the rejections of all pending claims.

Conclusion

The Applicants respectfully submit that all pending claims should be in condition for allowance. However, if the Examiner believes certain amendments are necessary to clarify the present claims or if the Examiner wishes to resolve any other issues by way of a telephone conference, the Examiner is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

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